St. Paul," mentions that Adrian set sail about daybreak, and at noon had obtained a distance of 500 stadia,—*καὶ ἠλθομεν πρὸ τῆς μεσημβρίας σταδίους πλείονας ἢ πεντακοσίους*, or more than fifty geographical miles—a speed of at least eight miles per hour.

That, indeed, the subject of Ancient Galleys is of great interest, and one fraught with many difficulties, I think will be acknowledged by every classical student. In the various remarks concerning the manner of rowing these ships, I have not pretended to solve the difficulties; but rather to place in a concentrated form the various theories of the most eminent writers on this subject.

The Secretary of the Academy read a paper, by Lord DE Ros (communicated through the President)—

ON THE CONSTRUCTION OF ANCIENT GALLEYS, AND THE ARRANGEMENT OF THEIR OARS AND ROWERS.

THERE are few subjects which have attracted more notice and discussion among classical students, than the details of the navigation of the Greeks and Romans; and this matter seems doubly interesting, from the probability that in any future naval warfare, we may see practised (though with far more terrible and destructive effect) by the steam rams of late invention, the very same manœuvre of charging "prow to prow" which we read of at Actium and other great sea fights of ancient times.

Propelling by steam, whether by the use of paddle-wheels or screws, brings back, in truth, after the lapse of so many hundred years, the great principles of naval warfare to several of the same conditions which arose from the propulsion by oars; and, indeed, it is only of late years that the speed of steam vessels has been brought to exceed so vastly that of the row Galleys of former times.

In that amusing book, Smollett's "Travels in Italy," about the year 1760, he describes the mode of coasting from Spezzia to Nice by passage boats, rowed with oars, as by no means a tedious way of travelling, when favoured with tolerably smooth water; and the writer of this Paper recollects, when on a military mission to the Black Sea, in 1835, that the "Pluto," a man-of-war paddle steamer, in which he traversed that sea both from E. to W. and from N. to S., took six days for the former, and three for the latter passage; which is the very time mentioned by Strabo as occupied by a Galley of his day in performing her *πλοῦς* of those very same distances in the Black Sea.

It must be mentioned, however, that the "Pluto" was a gun brig converted into a steamer, and of such inferior quality, that, when going at her best speed, seven or eight knots was all she could accomplish. Now, there is no doubt but a Greek or Roman Galley could fully perform that rate, and even more, for short distances, and in smooth water. But to attain any rapid speed with oars, it is scarce necessary to say that the rowers must have good room, and scope for the stretch of arm and play of every muscle. A cramped position, or an ill-balanced

oar, especially if heavy overboard, and without the proper proportion of leverage from the handle to the vessel's side, will very soon fatigue and cripple the stoutest and most expert oarsman.

In accepting, therefore, any theory as to the arrangement of the rowers and rowing benches of the ancient Galleys, we must never lose sight of certain conditions, familiar to all who are accustomed to the uses and application of the oar.

In the first place, we will consider the length of oar which can be used with the best effect by a single individual.

The most approved length in the present day for rowing those numerous matches which are daily occurring during the summer months in every part of Great Britain (for there is hardly a creek large enough to float a boat where you will not find a rowing match advertised once or oftener every year), the most approved length of the oar is from 12 to 13 feet. In some sea-shore matches, oars may be found of 15 or 16 feet; but that is quite the limit to which the length of a "match" oar is carried in the present day.

The proportion overboard and inboard (being the leverage exercised in drawing the oar through the water) is the next consideration; and it is generally held by good oarsmen that the oar should be about twice and a half as long overboard as it is inboard—that is to say, if the oar be 3 ft. 6 in. inboard, there should be a length beyond the rowlock of 8 ft. 9 in. outside the boat.

At the Great Exhibition, some oars, from America, were shown, of about 40 feet in length, and we see oars nearly as long used in the Thames' coal lighters; but these are only used in guiding the craft in the stream, and the strongest man could not move them fast enough for propelling even an empty lighter through the water faster than one mile an hour. Gun brigs were formerly provided, by the regulations of the navy, with a few sweeps, of 36 feet long; but these were only used for an occasional effort to move the vessel a short distance, and in dead calms—quite a different thing from regular "rowing." In fact, it may be safely asserted that 16 feet is the very longest oar that can be applied to rapid motion by a single rower. But if we admit the theory of the trireme having three men to each oar, there is no doubt but that oars of 26 or 28 feet long may have been used by them.

It is the manner in which these oars were placed that we have now to consider, reconciling, if possible, the practical use of the oar with the theories which have been set up as to the terms "trireme," "quinquereme," &c., so constantly occurring in the ancient historians, and so variously explained by their translators and critics.

Many of these have, in their ignorance of maritime detail, adopted the notion that a trireme had three rows of oars, worked each by one rower, and that the transtra, or benches, were one over the other; in other words, that a trireme was a sort of three-decker, only of oars instead of guns.

Now, as the very lowest height in which a man could sit in a rowing position is 4 ft. 6 in., and as the lowest height of the lowest range of oars

in a sea-going Galley, must be about 2 feet from the water (see Diagram A), a trireme, thus constructed, would present a side of 13 feet high, or thereabouts, above the surface of the water,—far beyond what can be allowed, with any probability, for any vessel impelled by oars. Indeed, this is as high out of water as our old thirty-six-gun frigates, and such a vessel could have no stability without such a draught of water and weight of ballast as must entirely unfit her for propulsion by oars. To haul her up on the shore (as we know they hauled up the Galleys), would have been utterly impossible.

DIAGRAM A.

Here it may be well to call attention to the remarkable fact, that nowhere in the classical authors can any mention be found of the use of *ballast* for their Galleys,—a fact which shows how entirely the ancients considered sails as a mere adjunct to the use of the oars, *ballast* being as obstructive to the requirements of a vessel propelled by oars as it is necessary to a vessel which depends upon sails for her propulsion, as well as for her stability and safety.

It may be said, in answer to this, that Virgil, in the Fourth Georgic, does allude, by the term "saburra," to ballast, when he describes the bee as taking up a small weight to steady itself in its flight; but it is evident he is alluding to light skiffs, used in fishing, which took sand on board to steady them, and not to large war Galleys, which, if ballasted, could neither row fast, nor be hauled up on the beach, as we know was their frequent custom.

There is another point connected with the absence of ballast in the ancient Galleys: it explains, what otherwise seems so strange, "that they never attempted what is termed beating to windward," but always used oars to go against the wind, and only hoisted the sail to run before it. In fact we find, both in Homer and Virgil's description of sea storms, that the approach of bad weather was the signal for striking sail, and taking to the oars,—very different from the seamanship of these days.

Æneas, when narrating the storm in which his fleet had been caught, and tossed in danger and darkness for three days, tells Dido, that on

getting a glimpse of land, "remis incumbimus," having previously lowered their sails,—showing that it was the oar, and not the sail, on which they put their reliance in time of danger and difficulty.

Beautiful and picturesque as is Virgil in his descriptions of vessels caught in a storm at sea, a very cursory comparison must show the observant student, that Virgil possessed little of that practical knowledge of vessels and seamanship, which we find in Homer. Virgil describes his storm with all the fire and grandeur of poetry, but Homer adds considerable practical knowledge of maritime details to his sublime powers of painting the "wonders of the deep," as seen and felt by those "who go down to the sea in ships;" witness his admirable description in the "Odyssey" of the way in which Ulysses managed to rig up a sail, and contrive a steerage for his raft, when he escaped going to the bottom with his vessel. It is just the account which a thorough seaman of our time would give of such an adventure, and is as intelligible to a Torbay fisherman as to an educated student, perhaps in many cases much more so. And here occurs the consideration of a most important feature in ancient seamanship,—the invariable use of a steering oar or paddle instead of the rudder, which last contrivance we can trace back to the ships of the Norman and Danish sea kings, but not to classical times.

It is clear that the "steering oar," or "gubernaculum," was not attached to the vessel's stern, but independent of it. . . . . "Gubernaclum multa vi forte revulsum præcipitans traxi mecum" is the description (and most animated and spirited it is) of the means by which Palinurus tells Æneas, in the Shades, that he escaped drowning, when knocked overboard by the fraud of Somnus—showing that he was steering exactly as the coxswain of a whale boat does at the present time, which is done by a skilful turn and pressure of the oar on the quarter of the boat, and not by any fixed machine of the nature of a modern rudder.

The number of rowers for a trireme in the Punic wars was estimated at 300. Now, taking the length of the Galley to be about 120 feet, and allowing some space forward and aft, as would be of course necessary, we shall find there would be length for about 25 transtra, at 4 feet apart; and, placing six men on each transtrum, three to each oar, we shall just arrive at a complement of 300 rowers in a trireme Galley—a few feet longer than one of the Thames steam-boats—while the width of 13 feet would give each rower a lateral space of full 2 feet, which is enough for the free use of his arms, and shoulders.

Montfaucon, with his usual accuracy, gives a *précis* of the different views taken by the commentators and critics of the arrangement of the rowers and oars on board the Greek and Roman Galleys; but, being himself unacquainted with such matters, he contents himself, wisely, with placing the different theories before his readers, and leaving them to form their own judgment.

No doubt there are many medals and sculptures which represent Galleys with more than one range of oars; but, if examined closely, it will

be found that from almost entire absence of proportion, and little regard to perspective, no reliance can be placed on such delineations, for elucidating and explaining the details, of the rowing arrangements of the Galleys of the ancients. In several medals we see the oars simply projecting through small round orifices—a thing manifestly inconsistent with the necessary power of letting the oar swing alongside, or even stowing it on board, when at anchor, or under sail; besides, we have many proofs that the ancients worked their oars on a peg, "scalmus," with a loop, or grommet, through which the oar was passed. The term "colligere arma" was applied to the operation of stowing the oars, as well as to striking and stowing the mast and sail. (See Diagram D.)

DIAGRAM D.

In that elaborate work, "The Antiquities of Herculaneum," compiled by some of the most learned of the Italian Academicians of the last century, there are (among many preposterous representations of ancient Galleys) one or two, which greatly favour the opinion, that there was but one range or deck of oars, and that the terms of trireme and quinquereme applied to the number of men who handled each oar,—the only theory which can be reconciled with practical results, and which was exemplified in the French, Maltese, and Spanish Galleys of the seventeenth, and early years of the eighteenth centuries.

Having endeavoured in short compass, and we fear in a very imperfect manner, to expose the difficulties which attend any attempt to reconcile the theory of banks of oars, one above the other, with the practical use and requirements of the oar, we now proceed to the question whether a solution may not be arrived at, by adopting the proposition (see Diagram C) that the terms "trireme," "quinquereme," &c., meant simply the number of men who handled each oar, and not a number of banks or decks, one over the other, with one man to every oar.

DIAGRAM C.

In the first place (taking the case of a trireme), an oar which would

rest on a fulcrum eleven feet above the water level (see Diagram B), as must be the case with the top row of oars, if the theory be admitted of the rowers being one above the other, in tiers or decks, could not even reach the water, unless it were thirty-two feet *overboard*, to balance which you cannot allow less than twelve feet *inboard*. Now, such a long oar as forty-four feet would be quite beyond any man's handling, even if he stood up, as you see the London lightermen doing; besides, Virgil uses the expression "considunt transtris;" and a standing attitude would be far too fatiguing for rowing any long distance, or at any rapid rate, no matter whether in a large Galley or a small boat. Then, to use oars of any such length, you must suppose a Galley to be twenty-six feet wide, which is entirely inconsistent with any degree of speed under oars.

DIAGRAM B.

Sir Walter Raleigh, as thorough a seaman as he was an able and gallant soldier, observes, in a note to chapter i., book v., of his "History of the World," that "Some have thought that quinqueremes had 5 ranks of oars, one over the other, and the triremes 3; but had this been so, they must then have had 5 decks, each over other, which hath seldom been seen in ships over 1000 tons; neither could the 3rd, 4th, and 5th ranks have *reached unto the water with their oars*."

But, as we are met by so many difficulties in endeavouring to discover the arrangement of the oars in the Galleys of the Greeks and Romans, will it be deemed unreasonable to suggest, that, after all, the Maltese Galley of the seventeenth and early part of the eighteenth centuries was probably a sample of the vessels of that class which had for hundreds of years been the common war vessel of the Mediterranean? No doubt, many improvements may have been made upon those of the Greeks and Romans; but it certainly is the universal opinion of scientific and experienced *seamen* who have frequented Malta, that, with all our present skill in construction, it would be impossible to produce a swifter or better vessel for propulsion with oars than the Maltese Galley, a very elaborate model of which was transferred some years back from that island to the United Service Museum in London. She is twelve feet long, and every detail is so accurately executed, that the most fastidious naval critic can discover nothing faulty in her construction. The form of the hull is exquisitely moulded for speed; and it is curious how closely it resembles,

though in more delicate lines, and with less proportional width, the shape of those fast and beautiful little steamboats which ply daily between London-bridge and Chelsea. Remove their paddles and machinery, and equip them as triremes, and you would probably turn out a Galley with which a Greek or Roman shipwright could have found few faults.

The dimensions of these steamboats (which have been ascertained in reference to this discussion) are as follows :—

	Ft.	In.
Length,	110	0
Width, or beam,	13	0
Draught of water,	2	0
Height of deck from surface of water,	3	10

It is the great merit of these vessels that their draught of water is so very little, in regard to their size and stability—an element of no small consequence in the construction of any vessel impelled by oars.

Those who are familiar with that delightful work of the immortal Cervantes, will remember the picturesque and lively description of Don Quixote and Sancho's visit to the admiral's Galley at Barcelona, where the author (himself an accomplished seaman, who mentions, with honest pride, the loss of his own hand at the great sea fight of Lepanto) gives a spirited and graphic account of the manœuvres of a Spanish Galley, renowned for speed and beauty, in her rapid chace of a corsair. Any one who will peruse this narrative, and then inspect the Maltese model, before alluded to, will hardly entertain a doubt of the identity, in general form and arrangement, of this kind of vessel with the Galley of Greece and Rome.

In one respect (but in reference to the rowers, and not the vessel), a wide difference is to be remarked. The art of rowing, which was estimated so highly by the ancients, had degenerated in latter times into a labour for slaves, and was considered the vilest of toil :—

> "Some, plunged in mines, forget the sun was made;
> While others, deathless as their haughty lords,
> Are hammered to the galling oar, for life,
> To plough the winter wave, and reap despair!"

To show how differently the Greeks viewed the skilful handling of the oar, we have the curious story in the "Odyssey" of Elpenor, who fell down drunk from a tower, and broke his neck. So proud does he seem to have been of his "rowing," that, when his shade is represented entreating for funeral honours to his corse, he specially requests that an *oar* may be the distinguishing emblem upon his tomb! Pope's translation of the passage is too graceful to be omitted :—

> "Then, high in air, memorial of my name
> Raise the smooth oar, and bid me live to fame."

This paper has now, it is feared, exceeded due bounds, but there is one point, in regard to ancient navigation, too remarkable to be passed over,

and which does not seem to have attracted much critical observation. The anchor is one of the most valuable and necessary equipments of a vessel, from the three-decker to the fishing smack; it is the simplest and most effective of contrivances; it has taken a place in poetry, in painting, and in sculpture; it is become an emblem introduced in allegory, and in metaphor, as well as in our every-day conversation. Is it not most strange, then, that we cannot trace the form of an anchor in any sculpture, or description by classic authors?

The λίθος τρητός and the εὐναί were just heavy stones, used, as we see even now in fishing skiffs, for mooring; but they were not anchors. Virgil's expressions of "dente tenaci, et unco morsu," prove that the ancients had some sort of curved hooks for mooring their vessels; but it is very doubtful whether the form was at all like that of our anchor; it seems rather to have been a sort of grapple, such as a man-of-war's boats are usually provided with (Diagram E), but which has been quite superseded in our times by the "anchor" for vessels of any burthen. DIAGRAM E.

With one more observation we shall now conclude. Much stress has been laid by some critics on certain technical terms, which they hold to bear upon the arrangement of the oars of ancient Galleys, especially the three designations of θαλαμίαι, ζευγῖται, and θρανῖται.

Now, there is no profession or art more remarkable for all manner of misapplication of terms than that of the seaman. What will the student or professor of five hundred years hence be able to make of the term "forecastle?" Will he ever guess that in a small merchant vessel it means, not even an elevation, or turret, but a low, dark place, forward, more like a dog kennel than a castle, where the seamen hang their hammocks for sleeping? Will he ever guess that a "messenger" means a piece of chain? or that a "sheepshank" is a peculiar knot for shortening a rope, and has no sort of connexion with a leg of mutton? Will he discover that the "boatswain" has charge of the ship's sails, ropes, and spars, but has little to do with the *boats?* And, above all, will he ever imagine what is meant by the term commonly applied to our large class of frigates, about twenty years ago, of "double-banked frigates?"—a term which was solely applied to vessels with guns placed along the whole upper deck, and without the smallest relation to *banks* or *benches* of any kind? And if these incongruous terms puzzle him, what in the world will he think of a class of vessels, common in our navy about thirty years ago, and called by the name of "donkey frigates?"*

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* Since the above was laid before the Royal Irish Academy, it has come to the knowledge of the writer, that a very similar question having been recently raised among the learned in Paris, it was resolved by the Emperor, with his usual practical acuteness, to test the matter by actual experiment. The savans were accordingly placed in commu-